

Authors

Kie Y. Ahn

Thomas J. Watson Research Center, Yorktown Heights, New York

B.S. in Electrical Engineering, 1958, Oregon State College; M.E.E., 1959, and Ph.D. in E.E., 1963, Rensselaer Polytechnic Institute. Joined IBM at the Research Center in 1963, and worked in the field of magnetics. Is currently studying ferromagnetic rare-earth compounds. Member, American Physical Society, IEEE, American Vacuum Society and Sigma Xi.

Andrew E. Brennemann

Thomas J. Watson Research Center, Yorktown Heights, New York

B.S., 1949, and M.S., 1950, both in Electrical Engineering at the University of Cincinnati; M.S. in Physics, 1961, Syracuse University. Joined IBM in 1950 and worked on the electrostatic storage system of the 701 machine and later the barrier grid tube storage system of the 770 machine. Worked in the ferroelectric device area and, later, in the cryogenic area at the Thomas J. Watson Research Center. Presently a member of the Solid State Electronics department. Member of Tau Beta Pi, Eta Kappa Nu, and IEEE.

Alan V. Brown

Thomas J. Watson Research Center, Yorktown Heights, New York

B.A., 1952, Cambridge University; Ph.D. in Electrical Engineering, 1956, Stanford University. From 1953 to 1956, he was a Research Assistant at Stanford Electronics Research Laboratory investigating the transient effects of pulsed microwave electron tubes. For the next two years, he was a staff engineer with Ferranti Ltd., England, where he worked on the development of pulsed klystrons. He joined the Research Center in 1959, and was manager of the Electron-Beam Technology Group until 1965. He now heads a group studying computer-system interconnection problems.

Ching-Chao Cho

Louisiana State University, Baton Rouge, Louisiana

B.S., 1953, Taiwan University; M.S., 1961, North Carolina State University; Ph.D., 1967, Iowa State University, all in Electrical Engineering. Associate engineer working on airplane simulation at the Boeing Company, 1961-62. As graduate student at Iowa State, did research on thin magnetic films. Since February, 1967 has been Assistant Professor in Electrical Engineering at L. S. U. Member, IEEE.

James M. Daughton

Systems Development Division, Burlington, Vermont

B.S., 1959; M.S., 1961; Ph.D., 1963, all in Electrical Engineering at Iowa State University. Joined IBM in 1963 at the Thomas J. Watson Research Center to investigate coupled film memory devices. In 1963 he transferred to his present position as manager of device evaluation in the film memory technology area at Burlington. Member, IEEE, Eta Kappa Nu and RESA.

Ronald A. Delaney

Components Division, East Fishkill, New York

B.S. in Physics, 1962, MIT. Served as an officer in the U. S. Army Chemical Corps, 1959 to 1961. During his time in the service he was Assistant Schools Secretary of the Top Secret U. S. Army CBR Weapons Orientation School, Dugway Proving Ground, Utah, for which he received a Department of the Army achievement award. He was employed in the Semiconductor Research Division of the Raytheon Corporation from 1961 to 1962, and then joined IBM at Poughkeepsie, where he worked in thin film technology until 1963. Since then he has been

engaged in materials and processes development as applied to electronic systems and computers. This has included work in ferroelectronics, semiconductors, and monolithic technology as applied to logic and memory development and measurement. Member, American Physical Society and RESA.

Barry L. Flur

Systems Development Division, Hursley, England

B. Metall. Eng., 1955, Polytechnic Institute of Brooklyn; M.S. in Metallurgical Engineering, 1958, and Ph.D., Metallurgical Engineering, 1960, Carnegie Institute of Technology. Joined IBM in 1959 at the laboratories in Poughkeepsie to work in studies on magnetics and the physics of metals. Currently assigned to the Systems Development Division Laboratory in Hursley, England, where he is investigating the properties of magnetic thin films.

Maurice E. Fowler

Data Processing Division, Scientific Center, Palo Alto, California

B.A. in Physics, 1948, University of Iowa. Worked at Collins Radio in Cedar Rapids, 1950 to 1952, and at Convair Astronautics, 1952 to 1959. Joined IBM in 1959 at the Federal Systems Division in Owego and later transferred to the laboratories in Kingston. He began work in 1964 at the Palo Alto Scientific Center, where he has pursued his interests in digital simulation, control systems analysis and numerical analysis. Member, Simulation Council.

M. Hatzakis

Thomas J. Watson Research Center, Yorktown Heights, New York

B.S. in Electrical Engineering, 1964, New York University; has completed work for M.S. in E.E. at N. Y. U. Joined IBM at the Research Center in 1961, working in the electron beam group. Participated in development of the electron beam recorder for the Photostore Project, and in the large-scale circuit integration program. Presently working on the development of microfabrication techniques using electron beams. Member, Tau Beta Pi and Eta Kappa Nu.

Harold D. Kaiser

Components Division, East Fishkill, New York

B.A. in Chemistry, 1949, University of Buffalo. Worked at Bell Aircraft from 1956 to 1961 in research on rocket propellants and materials corrosion. Started work with IBM in 1956 at the laboratories in Kingston, and transferred to the Components Division in 1961. He is now managing a group working on module design and development for thin film memories. Member, American Chemical Society and RESA.

George E. Keefe

Thomas J. Watson Research Center, Yorktown Heights, New York

Joined IBM Manufacturing Division in Poughkeepsie in 1952, working on 704 series computers and transferred to the Research Division in 1958, where he is now working in the magnetic circuits and devices group.

Tung-Po Lin

University of Malaya, Kuala Lumpur, Malaysia

B.S. in Chemical Engineering, 1949, University of Nanking; Ph.D. in Physical Chemistry, 1958, MIT. Was employed by the Dupont Corporation in Wilmington from 1958 to 1961. Joined the Mathematics Department of San Fernando State College in 1962, where he was an Associate Professor. During the academic

years from 1962 through 1967 he was consultant to the advanced technology area of the IBM Systems Development Division, San Jose. He is now a member of the Mathematics faculty at the University of Malaya.

George C. Maling, Jr.

Systems Development Division, Poughkeepsie, New York

A.B. in Physics, 1954, Bowdoin College; S.B., S.M. in Electrical Engineering, 1954, MIT; Professional Degree in Electrical Engineering, 1958, MIT; Ph.D. in Physics, 1963, MIT. Was a member of the DSR Staff at the Massachusetts Institute of Technology, 1963 to 1965. Joined IBM at Poughkeepsie in 1965 to work in the Acoustics Laboratory as an Advisory Physicist. Member of Sigma Xi, Tau Beta Pi, Eta Kappa Nu, Acoustical Society of America and IEEE. Chairman of the Systems Subcommittee of the IEEE Standards Committee of the Group on Audio and Electro-acoustics.

Harlan D. Mills

Federal Systems Division, Center for Exploratory Studies, Rockville, Maryland

B.Sc., 1948; M.S., 1950; Ph.D., 1952, all in Mathematics, Iowa State University. Has taught mathematics at Iowa State, Princeton, and New York Universities and has been a member of the technical staffs of General Electric and RCA. Joined IBM in 1964 at the Federal Systems Division in Rockville, where he is presently engaged in mathematical studies of large programming systems and numerical processes. Member, American Mathematical Society, Mathematical Association of America, SIAM, American Statistical Association, Econometric Society, and the Association for Computing Machinery.

Satish K. Mullick

Components Division, East Fishkill, New York

B.Sc. (Hons.), 1954, St. Xavier's College, Calcutta; M.Sc. (Tech.), 1958, Institute of Radio Physics and Electronics, Calcutta University; Ph.D. in Electrical Engineering, 1965, Cornell University. Formerly a Research Assistant at the Council of Scientific and Industrial Research, India, and Research Scholar and Associate Lecturer, Indian Institute of Technology in Kharagpur, India. Joined IBM in 1965 at the Components Division Laboratory in East Fishkill to study phenomena of loaded transmission lines in microelectronic technology. Member, IEEE.

Robert A. Myers

Thomas J. Watson Research Center, Yorktown Heights, New York

A.B., 1958; A.M., 1959; Ph.D. in Applied Optics, 1963, all from Harvard University. Student employment with Bell Telephone Laboratories (summer, 1957), M.I.T. Lincoln Laboratory (summer, 1959) and Technical Operations/Research (consultant, 1962). Joined IBM Research Division in December, 1963. Has since studied laser applications and, particularly, modulation and deflection. Member, Phi Beta Kappa, Sigma Xi and American Physical Society.

Knut S. Nordby

Systems Development Division, Endicott, New York

Dipl. Eng. in Electrical Engineering, 1951, Swiss Federal Institute of Technology. Was at the Swiss P.T.T. Laboratory in Berne from 1951 to 1953, and at Studer College in Zurich from 1953 to 1956. He worked on the STRETCH computer and hydraulic logic projects at the IBM Research Laboratory in Zurich from 1956 to 1960. Was a computer products representative for continental Europe with Ampex International Headquarters from 1960 to 1962. Rejoined IBM in 1962 at Poughkeepsie to work in the Acoustics Laboratory, and in 1966 trans-

ferred to Endicott where he is a Development Engineer in the Acoustical Technology department. Member, Acoustical Society of America, IEEE and AES; has been Chairman of the IEEE Subcommittee on Methods of Subjective Measurements.

Robert V. Pole

Thomas J. Watson Research Center, Yorktown Heights, New York

Ph.D. in E.E. (equivalent degree), 1953, University of Zagreb, Yugoslavia. Subsequently worked with Radio Industrija in Zagreb, with AWB in Dachau, and with ELNA, G. M. bH in Hamburg. In 1957 joined the Electronics Laboratory of General Electric Company, where he was primarily engaged in analytical aspects of thermoplastic recording. In June, 1961, joined IBM Research; subsequently, has worked in the field of optics and laser applications. Concurrently, completed course requirements for Ph.D. (Physics) at Syracuse University. Now manager of the optical physics research group. Member, Optical Society of America and IEEE.

Elisabeth M. Rutz, née Philipp

Federal Systems Division, Center for Exploratory Studies, Gaithersburg, Maryland

B.S., M.S., and D.Sc., 1946, in Applied Physics, University of Vienna. Worked at Siemens and Halske in Germany from 1938 to 1948, and at the Emerson Research Laboratory, Silver Springs, Maryland from 1955 to 1961. Joined IBM in 1961 at the Federal Systems Division in Bethesda. In February, 1966 she was transferred to the Center for Exploratory Studies as an Advisory Physicist in the Quantum Electronics Department, where she is engaged in applied research in the field of non-linear optics. In particular, her present research is an extension of former work on parametric devices at micro-wave to optical frequencies. Senior member, IEEE.

Albert J. Speth

Thomas J. Watson Research Center, Yorktown Heights, New York

B.E.E., 1956, Manhattan College and M.E.E., 1958, Syracuse University. Worked on sensors and circuits for navigation systems at New York University Research Division, 1958-61. Joined IBM Research in 1961, then working on development of electron beam systems for memory and microcircuit applications. Presently engaged in development of precision electron deflection systems. Member, IEEE and Eta Kappa Nu.

Richard F. M. Thornley

Thomas J. Watson Research Center, Yorktown Heights, New York

B.A. in Physics and Electronic Engineering, 1957, and Ph.D., 1960, both at University of Cambridge. As doctoral candidate worked on the formation and application of fine electron beams to scanning electron microscopy. In 1961, he joined IBM at the Research Center, where he worked on the application of electron beams in data recording. Since 1965 he has been Manager of the Electron Beam Technology group.

Ralph M. Warten

Data Processing Division, Scientific Center, Palo Alto, California

B.S., 1957, Brooklyn College; M.S., 1959 and Ph.D., 1961, Purdue, all in Mathematics. Joined IBM in 1961 at the Federal Systems Division laboratories in Owego and transferred to the Palo Alto Scientific Center in 1965. Has worked in the fields of numerical solution of ordinary differential equations and stability theory of ordinary differential equations. Member, American Mathematical Society, Mathematical Association of America, Pi Mu Epsilon, Sigma Xi and Phi Beta Kappa.

● *Controls papers:*

Preface 360

A Generalized Legendre-Clebsch Condition
for the Singular Cases of Optimal Control
by *H. M. Robbins* 361Rapid Computation of Optimal Trajectories
by *K. R. Brown Jr. and G. W. Johnson* 373Some Results in Two-Point Boundary
Value Problems
by *S. M. Roberts and J. S. Shipman* 383Computer Control of a Paper Machine—
an Application of Linear Stochastic
Control Theory
by *K. J. Åström* 389On-Line Identification of Process Dynamics
by *E. B. Dahlin* 406Sensitivity Constrained Optimal
Control Synthesis
by *W. J. Budurka* 427Synchronization of Traffic Signals
in Grid Networksby *A. Chang* 436Design Principles for Sampled-Data Systems
with Application to Attitude Control of a
Large, Flexible Booster
by *L. A. Gilson, E. F. Harrold, and F. G. Kilmer* .. 442A Computer-Operated Manufacturing
and Test System
by *J. E. Stuehler and R. V. Watkins* 452● *Papers:*Properties of Insulating Thin Films
Deposited by RF Sputtering
by *W. A. Pliskin, P. D. Davidse, H. S. Lehman,*
and L. I. Maissel 461The Magnetization Mechanism in Single-Crystal
Garnet Slabs Near the Compensation Temperature
by *C. D. Mee* 468

The IBM Journal of Research and Development is regularly indexed and abstracted by Science Abstracts (I.E.E.-Britain), Chemical Abstracts, The Engineering Index, Physikalische Berichte, ASM Review of Metal Literature, Mathematical Reviews, Computing Reviews, Computer Abstracts (Technical Information Co. Ltd.-Britain), Bulletin Signaletique (C.N.R.S.-France), Solid State Abstracts, Instrument Abstracts (British Scientific Instrument Research Association), Psychological Abstracts, Computer Abstracts on Cards, Automatic Subject Citation Alert, and American Documentation Institute. Reproductions of the magazine by years are available on positive microfilm from University Microfilms, 313 N. First Street, Ann Arbor, Michigan.